Ontario
Ministry of
Labour

Occupational
Health and Safety
Division

Occupational
Health Branch
LIBRARY
USE UNTIL
JUL 5 1985
SCIENCE & MEDICINE

Occupational Health in Ontario

SCI. MED. DIV.

Volume 6, Number 2, Spring 1985

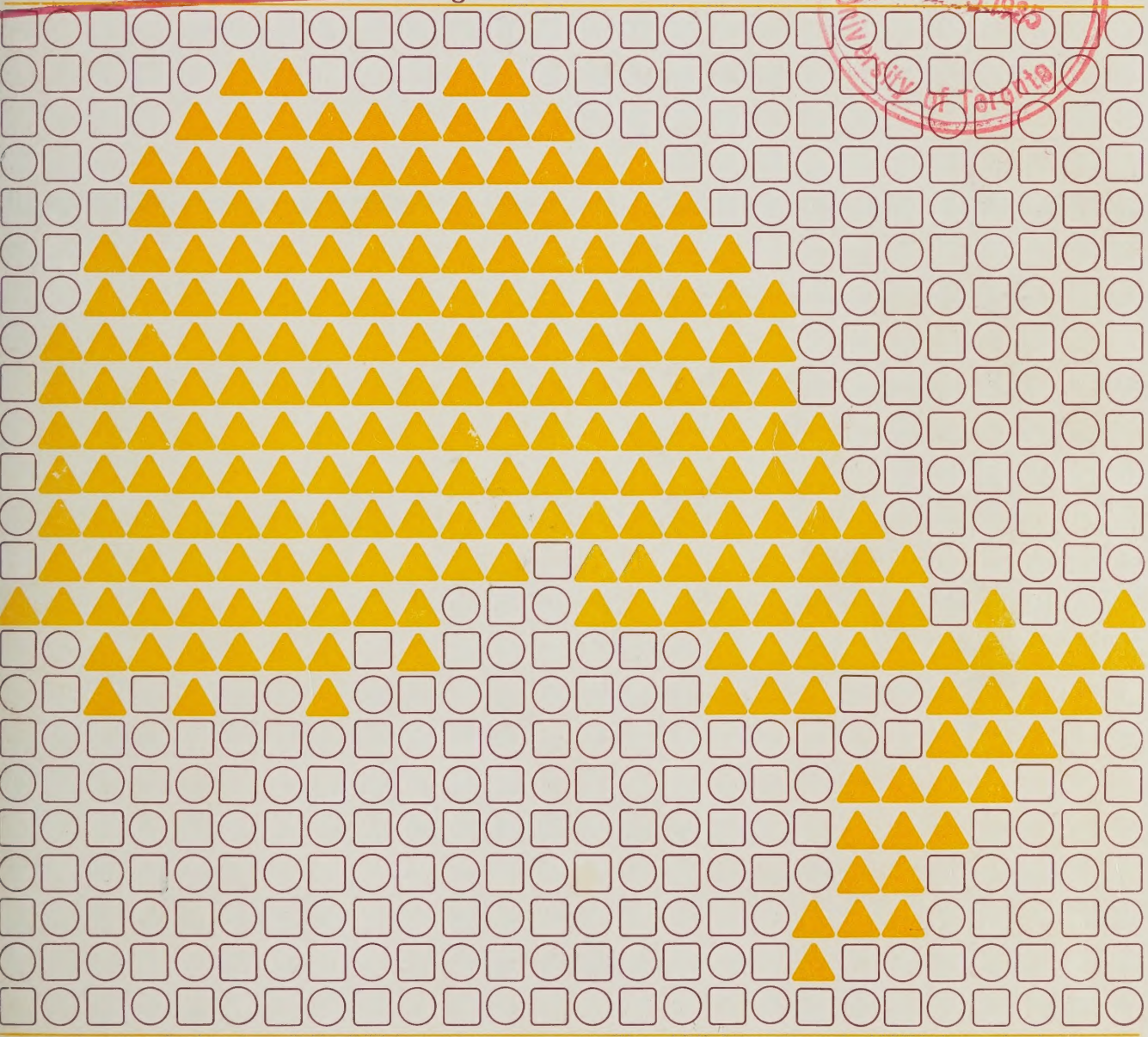
The Validity of Routine Audiometry in Industry

Organization and Management of Occupational Health and Safety Programs

Occupational Health and Safety Legislation: Highlights and Trends

Designated Substances Regs: Examining Physicians' Guidelines

CLEARED
JUN 3 1985
University of Toronto



Editorial Board

Editor
Dr. Peter L. Pelmear

Members
Miss M. Godin
Dr. Mark Nazar
Mr. Gyan S. Rajhans
Dr. J. Roos
Miss Catherine Wilbraham

Editorial Notices

While every effort is made by the publishers and editorial board to see that no inaccurate or misleading opinion or statement appears in this Journal, they wish to make it clear that the views expressed are those of the writers and do not necessarily reflect official opinion or policy. Accordingly, the publishers and the editorial board, and their respective employees, officers and agents, accept no liability whatsoever for the consequences of any such inaccurate or misleading opinion or statement.
Permission to reprint any material herein, with credit to the Ontario Ministry of Labour, may be obtained upon written application to the editor.

Contents

Correspondence *54*

Ronald A. House, M.D., C.M., D.I.H., C.C.B.O.M. — The Validity of Routine Audiometry in Industry *56*

J.W.F. Cowell, M.D., M.Sc., C.C.B.O.M. — Organization and Management of Occupational Health and Safety Programs *75*

Bryan J. Walker — Occupational Health and Safety Legislation: Highlights and Trends *87*

Designated Substances Regs: Examining Physicians' Guidelines *94*

Publications Available From the Government Book Store *101*

News and Notes *103*

Coming Events *105*

Additional copies of this publication may be obtained from the Ontario Government Book Store, 880 Bay Street, Toronto, Ontario M7A 1N8. Price $2.00. Cheques or money orders should be made payable to the Treasurer of Ontario

Occupational Health in Ontario

Volume 6, Number 2, Spring 1985

Notice to Contributors

Before beginning work on a manuscript, the author should read the editorial notices carefully and prepare the typescript in accordance with the instructions given. A further check of the material should be made before it is submitted, as corrections are very expensive after the article has been set in type.

The *manuscript* should be typed double spaced with three centimetre margins on each side of the page. Two copies are required for submission to the editor, and the author should keep a copy. The manuscript should contain the following components, each to begin on a new page in this sequence: title page; summary (up to 150 words); text; acknowledgements; references; tables (each table, complete with title and footnotes, on a separate page); legends for illustration. All manuscripts will be subject to referee's approval.

Illustrations should be clearly marked on the back to show number, orientation and author's name. Photographs should be good quality, unmounted glossy prints. Original art work of line drawings and graphs should be supplied. Lettering should be large enough to allow reduction. Authors should note that typewritten lettering is unacceptable, and transfer lettering should be applied.

References in the text should be numbered consecutively in arabic numerals. All references cited should be listed in the order in which they appeared, according to the reference citation recommendations issued by the Medical Section of the Library Association.

Two copies of both the manuscript and illustrations should be sent to:
The Editor
Occupational Health in Ontario
Occupational Health Branch
Ministry of Labour
400 University Ave.
Toronto, Ontario
M7A 1T7

Examples

1. Lee WR, and Miles S. Postgraduate preparation for occupational medicine. J Soc Occup Med 1976; 26: 115-119.
2. Department of Health and Social Security, Notes on the diagnoses of occupational diseases. Rev ed. London: HMSO., 1972.
3. Gamble JF, and Battigelli MC. Epidemiology. In: Clayton GD and Clayton FE. eds. Patty's industrial hygiene and toxicology. New York: McGraw Hill, 1978: Vol 1; 113-116.

Correspondence

To the Editor

The requirements specified in the Regulation 455/83 and in particular s.5, and the Code for Respiratory Equipment have created some confusion and consternation amongst isocyanate users. Of some concern is the stipulation that breathing air meet CSA Standards, in view of the analytical costs required to demonstrate this. Certainly, it is imperative that any information released by the Ministry be factual and reflect *current* standards.

The article 'Automotive Body Repair Shop Hazards' appearing in the Oct. 84 issue of *Occupational Health in Ontario* quoted CO, CO_2 and hydrocarbon limits from CSA Standard Z180.1.

Unfortunately, the quoted values were from the 1973 edition of the Standard, which has been superseded by the 1978 edition. If you compare the two sets of values, you will see the significant discrepancy between the two. In many cases, adjusting to the differences would necessitate the expenditure of thousands of dollars of additional capital.

	Z180.1-1973	**Z180.1-M1978**
CO	20 ppm	5 mL/m³ (≡ppm)
CO_2	1000 ppm	500 mL/m³
HC	50 mg/m³	25 mL/m³ (volatiles)

As well, the 1978 Standards list the Maximum Allowable Concentrations of a variety of other possible contaminants, either specifically (e.g. NO_2) or as 'shall not exceed the odour threshold, or 1/10th the TLV'. I understand that this Standard has been reviewed and revised, and is about to be reissued.

Perhaps the Occupational Health and Safety Division of the Ministry could clarify and iterate which standards it refers to in 'compressed air . . . [is] to meet CSA Standards'. . . (p.17 455/83).

Sincerely,
Ugis I. Bickis
Occupational Hygiene Consultant

Mr. Collinson's and Mr. Rajhan's response to Mr. Bickis is printed below.

To the Editor

Mr. Bickis has correctly pointed out our error in quoting values from the Table of Maximum Allowable Concentrations of Contaminants listed in CSA Standard Z180.1-1973 rather than the current edition Z180.1-M1978. We regret quoting the older standard and are grateful to him for bringing it to our attention.

When reference is made to a CSA Standard such as in the Code for Respiratory Equipment for Isocyanates, the reference is certainly to the current edition of the standard.

We, however, question Mr. Bickis's statement that to provide compressed breathing air that meets the current CSA Standard might cost thousands of dollars more than to provide air that meets the 1973 standard. It is our opinion that if the air compressor intake is located outdoors in an area free from contamination by engine exhaust gases, heating plants, ventilation systems, etc., no additional air purification equipment would be required to meet the maximum allowable contaminant concentrations of CSA Standard Z180.1-M1978.

G. Collinson, C.I.H.
G.S. Rajhans, C.I.H.

Ronald A. House, M.D., C.M., D.I.H., C.C.B.O.M.

The Validity of Routine Audiometry in Industry*

Summary

This paper reviews the controversy concerning the scientific and social validity of audiometry in industry. The components of validity — face, construct, content concurrent and predictive, together with reliability, are discussed with respect to pure-tone audiometry. The scientific validity can be improved by standardization procedures to reduce variability and by using action levels such as OSHA's standard threshold shift rule. It is concluded that companies should have hearing conservation programs that include audiometry for those employees exposed to noise levels at or above 85 dBA.

Ronald A. House, M.D., C.M., D.I.H., C.C.B.O.M.,
Special Studies and Services Branch,
Ontario Ministry of Labour,
400 University Avenue,
Toronto, Ontario
M7A 1T7

The controversy concerning the validity of routine audiometry in industry has existed for several years. Some authors such as Atherley *et al*[1] have made clear statements against the use of routine audiometry. However, the majority of physicians and scientists who have reviewed the use of audiometry in industry favour its utilization although they are concerned about some factors such as the reliability or repeatability of audiometric measurements and the action level chosen for a clinically significant audiometric threshold shift. These factors of reliability and the choice of action levels, plus other technical considerations, relate to the question of the scientific validity of audiometry. Discussion of scientific validity can be hampered by slightly different meanings for epidemiologic terminology in different scientific papers. For example, Atherley and Johnston[2] often use the term 'accuracy' when most epidemiologic references[3–5] would use the term 'validity'. Therefore, I have attempted to define all of the relevant epidemiological terms, such as validity, sensitivity, specificity, reliability, etc. when they are first introduced in this paper.

In addition to scientific validity, Atherley and Johnston[2] have recently introduced a new concept in the debate about the validity of audiometry and, indeed, of all medical monitoring in industry. This new term is 'social validity', which refers to the social consequences of audiometry and other types of medical monitoring in industry. These social consequences, according to the authors, include such factors as a potential conflict between human rights and medical monitoring. Therefore, this paper will also review the controversy surrounding the social validity of audiometry.

This topic of the scientific and social validity of audiometry is particularly relevant to occupational health in Canada because many companies have hearing conservation programs that include audiometry

*Based on a thesis submitted to the Canadian Board of Occupational Medicine in partial fulfilment of the requirements for certification.

as an important component. Furthermore, many provinces have introduced, or are formulating, legislation to require routine audiometry in workplaces with particular levels of noise exposure. In Ontario, for example, regulations will soon be implemented that will require audiometry when the noise exposure equals or exceeds 85 dB (A). Pelmear and Pike[6] state that the number of workers in Ontario estimated to be exposed to noise levels at or above 85 dB (A) is approximately 430,000. Hence, in Ontario alone, a large number of workers will be required to have periodic audiometry. The question of the scientific and social validity of audiometry is therefore very germane to occupational physicians as well as to employers and exposed employees.

Validity

Screening audiometry in industry involves using pure-tone audiometry to determine threshold hearing levels at various frequencies (at least .5, 1, 2, 3, 4 and 6 kHz). The intent of periodic audiometry is to identify those individuals with early hearing loss at the most noise-sensitive audiometric frequencies so that appropriate intervention may be instituted to minimize further hearing loss.

In general, the validity of a test refers to the extent to which the test properly measures or identifies the health effect that you want to measure or identify. Therefore, the validity of pure-tone audiometry in an industrial setting would refer to the extent to which audiometry correctly identifies or classifies those workers with or without hearing loss. Actually, validity is a complex epidemiologic term that has various components. Payton[7] has reviewed the various types of test validity, and Noble[8] has related these types of test validity to audiometric tests. As summarized by Payton,[7] the types of test validity include face, construct, content, concurrent and predictive validity.

Face validity refers to the extent to which the test appears to the subject or worker to measure what it purports to measure. Hence, this type of validity relates to the subject's acceptance of the test and can be important in winning a patient's co-operation. Patients will sometimes resist taking a test if it doesn't 'make sense to them', that is, if it doesn't appear to be related to something they can understand and accept. Pure-tone audiometry is obviously a test that workers can easily relate to as an assessment of their hearing, and, therefore, it has good face validity.

Construct validity refers to the theoretical construct of what you actually want to measure. In the context of measurement of hearing loss by audiometry, construct validity would address the question 'What is hearing loss?' Obviously, hearing loss refers to the ability to hear speech or everyday conversation or to detect common auditory signals that modulate or influence behaviour in everyday life.

Content validity refers to the extent to which the content of the test actually measures or assesses the theoretical construct that led to the development of the test. As mentioned, the ability to hear speech or common auditory signals in everyday life is the theoretical construct for rating the content of various tests designed to measure hearing. Therefore, speech tests such as the speech reception test and the speech discrimination test have better content validity than pure-tone audiometry and might be considered as more appropriate screening tests. However, as pointed out by Olishifski,[9] although speech tests have been widely accepted for use in aural diagnostics, several objections have been raised about their use in an industrial setting. The main objections are:

1) Considerably more training is required on the part of the examiner to administer and score speech tests than pure-tone audiometry.

2) It is difficult to standardize speech test material because of the language differences, the differences in intelligence, the size of the vocabulary and the educational levels of the subjects whose hearing is being tested.

Therefore, pure-tone rather than speech audiometry is used in industry. Various schemata have evolved to relate these measured pure-tone hearing levels at different frequencies to the ability to hear and understand speech or, conversely, to the presence of hearing handicap.

Concurrent validity refers to the relationship of the results of the test in question to the results of a 'gold standard' test. Concurrent validity is usually what is meant by the general term, 'validity'. Most frequently, concurrent validation is used to establish the validity of a new test by a comparison with an older test for which the validity is known. The same patients or workers would be tested concurrently by both the new test to be

validated and the gold standard test, and the results would be expressed in a 2 x 2 contingency table or decision matrix as follows:

		Gold Standard* Patient has the disease	Patient does not have the disease	
Test Result (Conclusion drawn from the results of the test)	Positive: Patient appears to have the disease	True positive a	False positive b	a + b
	Negative: Patient appears not to have the disease	c False negative	d True negative	c + d
		a + c	b + d	a+b + c+d

*Adapted from Reference #4

Various key epidemiologic terms may then be defined by referring to the Table. For the purposes of this discussion, the terms that should be defined are:

1) *Sensitivity = a/(a + c)*
This refers to the proportion of individuals with the disease (according to the gold standard) who are properly determined to have the disease according to the new test.

2) *Specificity = d/(b + d)*
This refers to the proportion of individuals without the disease (according to the gold standard) who are properly determined to not have the disease according to the new test.

3) *Predictive value of a positive test or the positive predictive value = a/(a + b)*
This refers to the proportion of individuals with a positive test result on the new test who actually have the disease (according to the gold standard).

The two main components of concurrent validity are sensitivity and specificity, and they relate to the ability of a test to properly assign individuals to their correct disease category (according to the gold standard). As pointed out by several authors,[4–5] the greater the sensitivity and specificity of a test and the higher the prevalence of the disease screened for in a particular group, the greater will be the predictive value of a positive test.

In the context of audiometry, concurrent validity would refer to the comparison of the results of pure-tone audiometry with the results of a gold standard test of hearing on the same subjects. For screening audiometry, the best gold standards are probably: 1) evoked response audiometry, which involves the measurement of the electrical activity of the brain when a sound stimulus is presented to the subject, and 2) pure-tone audiometry done in a clinical referral setting under the direction of an otologist.

Alberti *et al*[10] carried out both pure-tone audiometry and evoked response audiometry on 258 patients referred by the Ontario Workers' Compensation Board for adjudication of hearing loss of presumed occupational etiology. It was found that 20 per cent of the workers had a clear discrepancy (defined as a difference of 10 dB or greater on more than one audiometric frequency) when the evoked response audiometry was compared to the pure-tone audiometry. Therefore, 80 per cent of the pure-tone audiograms were confirmed or did not show clear discrepancy when compared with results of evoked response audiometry.

Dobie and Archer[11] compared the results of pure-tone audiometry with similar audiometry done by a consultant otologist. Of 31 periodic screening audiograms done in industry and referred for changes indicative of early noise-induced hearing loss, 25, or approximately 81 per cent, were confirmed by the consultant otologist. This 81 per cent is similar to the 80 per cent result of confirmation found by Alberti *et al.*

However, these results do not indicate a sensitivity of screening audiometry of approximately 80 per cent. The comparison of the results of screening audiometry with the results of either of these two gold standards would correspond to the a/(a + b) ratio in the previously discussed 2 x 2 Table. Therefore, the results represent a positive predictive value of industrial audiometry of about 80 per cent.

As Atherley and Johnston[2] point out, the calculation of sensitivity and specificity of industrial audiometry requires the results of consistently applied industrial audiometric tests in samples of workers with and without hearing loss as determined by the gold standard test. It is not possible to estimate the sensitivity and specificity of industrial audiometry from the data presented by either Dobie and Archer or Alberti *et al* since only persons with suspected hearing impairment, as measured by industrial audiometry, were studied.

Atherley and Johnston state that data on sensitivity and specificity as well as reliability of audiometric measurements should be considered minimal requirements for assessing if the criteria set out by the World Health Organization for screening tests have been achieved for a particular test like screening audiometry. However, a predictive value of a positive test of 80 per cent indicates that only 20 per cent of industrial audiometric tests were false positives (i.e. the worker was labelled to have noise-induced hearing loss that was not confirmed by referral). This is a relatively high predictive value for a screening test, but it is difficult to know exactly how this relates to sensitivity and specificity. The predictive value of a positive test is very dependent on prevalence, and it would increase with an increase in the prevalence of noise-induced hearing loss in the industrially screened group as well as with increases in sensitivity and specificity.

Predictive validity refers to the prediction of a particular course of development in health/disease as a result of the present test results. In the context of audiometry, predictive validity would refer to the prediction of future hearing loss and/or hearing handicap on the basis of existing audiometric results. This prediction would depend on knowledge of expected future noise exposure and use of hearing protection, and it also makes assumptions about the time course and magnitude of hearing loss changes due to presbycusis as well as to noise exposure.

At present, the preplacement audiometric and medical examination have poor predictive validity for determining which individuals will subsequently develop hearing loss. However, some workers are much more susceptible than others to noise-induced hearing loss, and until there is a valid predictive test to identify these highly susceptible individuals, the periodic audiometric test appears to be the only way to detect them. It is

hoped that this will occur after early subtle hearing loss so that intervention can be effected to prevent subsequent development of more severe hearing loss.

Reliability

Reliability refers to the repeatability of the results of a test. If a test, when repeated on the same group of subject, yields similar results, then the test is reliable.

A number of factors can contribute to poor reliability of pure-tone audiometry. These factors have been summarized in the Guide for Conservation of Hearing in Noise by the American Academy of Ophthalmology and Otolaryngology[12] and include the following:

Causes of Audiometric Changes

Physical Variables
Improper placement of earphones.
Ambient noise levels in test room.
Equipment variables, such as accuracy of attenuator steps (calibration).

Physiological Variables
Age and sex.
Pathology of the auditory organs.
General health of subjects.
Temporary threshold shift.
Tinnitus.

Psychological Variables
Motivation of subject.
Momentary fluctuations of attention.
Comprehension of instructions.
Experience in test taking.

Methodological Variables
Testing technique used (manual or automatic).
Time interval between successive tests.
Instructions to subject.
Order of presentation of frequencies.

This variability in audiometric measurements can be reduced by standardization of the test procedure. This standardization should include:

1) Training of audiometric technicians. The audiometric technician should hold a certificate of attendance from a recognized training program. The certificate should be renewed every two or three years.

2) Proper calibration of audiometric test equipment so that the equipment complies with the CSA standard.

3) Measurement of noise levels in the audiometric booth to ensure that they do not exceed CSA standards.

4) Standard and consistent instructions to workers about the protocol for the test.

Adherence to these standards will minimize or eliminate many of the sources of systematic error in audiometric measurements. The importance of achieving these standards in industry is emphasized by a 1975 NIOSH[13] investigation of hearing conservation programs in the United States that included on-site interviews and noise measurements at 80 companies. NIOSH reported that 80 per cent of the hearing test facilities in industry failed to meet standard calibration criteria for audiometric performance or background noise level limits.

However, even in those situations in which all of the standardization procedures are implemented to minimize systematic error, audiometric measurements still involve an unavoidable, inherent variability.

Robinson[14] (1960) described in considerable detail the problem of variability in audiometric measurement and the various components that contribute to variability. However, when all potential sources of systematic variability were controlled for under experimental laboratory conditions and audiometric measurements were carried out and then repeated after one to two months on a group of subjects with normal hearing, some variability remained. Of course, some variability is to be expected for most medical tests. The standard deviations of the differences between the test-retest hearing levels at various audiometric frequencies ranged from 2 dB in the left ear at 4 kHz to 5.7 dB in the right ear at 8 kHz.

Similar test-retest reliability results have been obtained in a laboratory setting by various researchers,

including Atherley and Dingwall-Fordyce[15] (1963) and, more recently, by Hetu[6] (1983). Hence their results corroborated those of Robinson.

However, these studies of audiometric test-retest variability were conducted under research conditions with highly trained testers, well-motivated normal subjects, plenty of time and well-calibrated equipment. Further studies were therefore needed to assess variability of audiometric measurements in industry.

Examples of industrial audiometric reliability studies subsequently carried out are those of High and Glorig[17] (1962) and Pelmear and Hughes[18] (1974). High and Glorig, using an automatic audiometer in a mobile test unit, did a study of initial and repeat audiograms after approximately a six-month interval on 79 employees. The authors stated that the audiometer and test conditions were similar to those encountered in an industrial setting. The standard deviations for the test-retest difference scores at each audiometric frequency ranged from 3.65 dB at 2 kHz in the right ear to 5.10 dB at 6 kHz in the left ear. Pelmear and Hughes, using self-recording automatic audiometry, carried out a study of initial and repeat audiograms of 118 drop forge employees. The time interval between the initial test and recall varied from one to 15 weeks because of the shift system and sickness absence. The test-retest standard deviations ranged from 6 dB at 6 kHz to 3 dB at 2 kHz. Hence the results were similar to those of High and Glorig.

A recent summary of reliability of audiometry by Dobie[19] (1983) reviewed these and other industrial reliability studies and concluded that the variability in audiometric measurement is greater in industry than in the otologic referral or laboratory settings. In general, the variability can be assumed to be about ± 5dB at each audiometric frequency.

Also, various industrial reliabilty studies allow a comparison of the two main types of audiometry used in industry — manual and automatic. As summarized by Atherley and Johnston[2] (1981), these studies indicate that there is little overall difference in variability for the two types of audiometry.

Audiometric Criteria for a Clinically Significant Deterioration in Hearing

The validity of industrial audiometry also depends on the criteria used to determine when a clinically important change in pure-tone threshold measurements has occurred. If the criterion is a fairly small loss of hearing at a single frequency — for example 10 dB at 4 kHz — the

percentage of false positives would be greater than if a more stringent criterion is used, such as an average loss of 10 dB at several frequencies. In 1983 OSHA published a new criterion of a significant shift, which they termed a 'standard threshold shift' (STS), defined as a change of 10 dB or more for the pure-tone average of 2, 3 and 4 kHz in either ear relative to the baseline audiogram.

The results of studies by Royster and Royster[20] support the OSHA criterion for STS. They compared several criteria for STS, including 10 dB or greater shift in the 2, 3 and 4 kHz pure-tone average and a number of criteria based on changes of 15-20 dB at any audiometric frequency. They considered a threshold shift to have been confirmed (true positive) when it occurred again on either of two succeeding audiograms. Of all criteria rules applied to a single audiogram with confirmation consisting of recurrence of the same threshold shift on either of two succeeding audiograms, the 10 dB shift for the 2, 3 and 4 kHz pure-tone average was the best. The results of a similar study by Dobie[19] also indicated that definitions of STS based on pure-tone averaging were superior to those based on 'shifts at any frequency' criteria. The author stated that 'it seems unlikely . . . that one would select as a criterion for STS anything but a three frequency average shift of 10 dB or more.'

Following verification of a significant threshold shift, OSHA stipulates that the employee *must be* provided with hearing protective devices if he or she previously had none, instructed in their use and notified of the measured shift in hearing level.

No provision is made in the OSHA regulation for medical consultation regardless of the extent of the observed hearing threshold shift. However, as Ruth[21] points out, this is a risky posture to assume since other forms of hearing loss, both conductive and sensorineural, that are unrelated to noise exposure may be partially or totally responsible for the shift in hearing threshold. For example, Alberti *et al*[10] carried out an extensive otologic and audiometric evaluation of 719 workers referred to them by the Ontario WCB for possible noise-induced hearing loss. They found that seven per cent of these workers had other otologic pathology that caused or contributed to the hearing loss.

Some obvious criteria for referral mentioned by Harford[22] would be 1) the continued progression of hearing loss after the identification of STS and the

appropriate intervention, and/or 2) the presence of an audiometric configuration different from that typical of noise-induced hearing loss with its characteristic high frequency (4-6 kHz) notch.

More detailed medical and audiological criteria guidelines for referral have recently been formulated by the Medical Aspects of Noise Committee of the American Council of Otolaryngology.[23]

In Ontario, the proposed regulation for noise[24] under the *Occupational Health and Safety Act* included a Code for Medical Surveillance, section 4(1) of which discussed audiometric action levels. The action level definitions for a) evaluation by the company physician, and b) referral for Workers' Compensation Board assessment were as follows:

Action Levels

a) 'Any significant confirmed deterioration in hearing from previous tests, e.g. 10 dB or more at any one frequency, 5 dB or more average over three adjacent frequencies, must be evaluated by the company physician, the noise exposure reassessed and the worker counselled. If the cause and diagnosis is uncertain, further otological investigation must be sought.
b) Workers with a noise induced hearing threshold average of 25 dB at 0.5, 1, 2 and 3 kHz in either ear should be referred for Workers' Compensation Board assessment.'

Hence the proposed criteria in Ontario for a significant threshold shift or audiometric action level are less stringent than OSHA's STS, and would result in more false positives than would the use of the OSHA action level. Also, the Ontario proposed regulations specify specific criteria for referral to the Workers' Compensation Board.

However, after publication of the proposed regulations, many objections to the action levels were received by the Ontario Ministry of Labour.[25] In general, these objections stated that the action levels were too low, especially considering that the estimated reliability of audiometric measurement is about ± 5 dB at each frequency. Therefore, the proposed action levels are being reconsidered, and, at present, no legislated action levels for evaluation by the plant physician or referral to an otologist or the Workers' Compensation Board exist in Ontario. However, most companies with hearing conservation programs have their own designated action level for evaluation and referral.

Summary of the Scientific Validity — Reliability Controversy

Some of the criteria needed to completely assess scientific validity, such as sensitivity and specificity, are not available from an examination of existing research results. However, the absence of data on sensitivity and specificity does not, by itself, invalidate industrial audiometry. The available research data indicate that the predictive value of a positive test for industrial audiometry is approximately 80 per cent. This is a comparatively high predictive value for screening tests.

Noble[8] mentions that the question of the scientific validity of routine audiometry in industry can be analogized to the signal-detectability field and phrased as follows: Can a genuine signal (e.g. true hearing loss) be accurately detected despite persistent 'noise' (e.g. audiometric variability)? Clearly, the key to maximizing the validity of audiometry is 1) to reduce the 'noise' or variability by the standardization of test procedures described previously, and 2) to improve and standardize the 'signal' by the use of an appropriate audiometric action level such as OSHA's significant threshold shift definition.

Therefore, audiometry carried out in industry under the appropriate test conditions to minimize audiometric variability and with the use of an appropriate action level for re-evaluation of employees should remain an important component of a hearing conservation program. This program also includes other components:

1) Noise measurment to assess which workers are most at risk of noise-induced hearing loss. The noise exposure level at which a hearing conservation program should be started is 85 dB (A) according to OSHA. Burns and Robinson[26] (U.K.) and Pelmear and Pike[6] (Canada) also recommend that hearing conservation programs should be introduced when the noise exposure equals or exceeds 85 dB (A).

2) Procedures for noise exposure reduction, including engineering controls, administrative controls and the provision of adequate hearing protection.

3) Worker education.

4) Record keeping.

Audiometry must remain a key component of the hearing conservation program for a variety of reasons including:

1) The need to monitor the effectiveness of the hearing conservation program. Atherley and Johnston[2] argue that in regard to checking on the effectiveness of hearing conservation programs, audiometry possesses a secondary rather than the primary role occupied by other scientific procedures such as measurement of the noise exposure of workers. They argue that an equation developed by Robinson[27] for relating noise exposure to the risk of hearing loss can be used to estimate the collective risk of a group of workers exposed to a particular noise level. However, as pointed out by Noble[8] and Robinson[27–28] himself, this equation allows prediction of the risk of hearing loss for groups of workers only and not for individuals. As discussed previously, there is actually considerable variability in individual susceptibility to hearing loss from noise exposure. Also, the preplacement audiometric test and medical examination have poor predictive validity for determining which workers will develop hearing loss. Therefore, for these workers, periodic audiometry is the only means of identifying such increased susceptibility and intervening to prevent future loss of hearing.

   Furthermore, just measuring noise levels may not be an adequate estimate of risk for the group as a whole if combined exposure to noise and other agents exists. For example, Manninen[29] has recently summarized a number of studies and carried out experimental studies of his own that suggest that combined exposure to noise and vibration (either segmental or whole body) may increase the magnitude of hearing loss over that due to exposure to just equivalent intensities of noise. Therefore, if Manninen's suggestions are true, measurement of noise levels only and the use of Robinson's equations to estimate hearing loss rates in the group of exposed workers will underestimate the true risk of hearing loss. Audiometry therefore remains the bottom line measurement or 'ultimate test of success' of a hearing conservation program as suggested by the Health and Safety (U.K.) Executive's Discussion Document of Audiometry.[30]

2) Motivation of employees to use hearing protection. Else[31] has shown that the attentuation of hearing protection falls off rapidly if the hearing protectors are not worn for short periods of time. In addition,

poor maintenance and improper use of the muffs or plugs may further lower actual attenuation. Audiometry may detect early hearing loss in those workers who are not using hearing protection effectively so that useful intervention can occur to improve compliance with the use of hearing protection. Also, Karmay and Martin,[32] in a study of the effects of audiometry and an educational program on the use of hearing protection, have demonstrated that the use of audiometry may increase the rate of employee usage of ear muffs and plugs in employees generally and not just in those employees with early hearing loss. In fact, the greatest increase in the percentage of employees using hearing protection in their study occurred in a plant in which audiometry (and no formal educational program) was the only intervention. The authors concluded that industrial audiometry represents a very cost-effective component of a hearing conservation program for, in addition to its role as a monitor of hearing function, audiometry allows periodic contact with workers that contributes to employee education in the hazard represented by noise and increases the usage of hearing protection.

3) Adjudication of medical-legal and Workers' Compensation Board cases. Baseline and periodic audiograms are of considerable use in this regard. The audiometric results determine which employees should be referred for further evaluation including Workers' Compensation Board claims for noise-induced hearing loss. Information regarding Workers' Compensation Board claims is also an important component used to motivate employers to lower noise exposure in industry.

Social Validity of Industrial Audiometry

Atherley and Johnston[2] define social validity as 'the totality of the effects, good or bad, of any medical test or procedure relative to factors such as human rights, the well-being and physical and mental health of the individuals identified and subsequently labelled as suffering from hearing loss; the costs to the health care system; the costs to individual workers and their work and the costs of Workers' Compensation.'

They are quite right in saying that such a complex entity as this definition of social validity has not been adequately or completely assessed for industrial audiometry. However, it is unlikely that many medical

tests have been subjected to such complex scrutiny.

In his discussion of social validity, Atherley[33] is principally concerned with what he describes as the potential conflict between human rights and medical monitoring as legislated by particular regulations. He feels that human rights in relation to medical monitoring touch on three main concerns:

1) The requirement of informed consent by the employee before a medical test like audiometry.

2) The prevention of job discrimination based on the results of medical monitoring.

3) The maintenance of the confidentiality of the results of medical tests.

He feels that these areas of potential conflict of human rights with legislated medical tests such as audiometry should be addressed and, it is hoped, resolved in the formulation of the regulations, possibly by public debate inside or outside the legislature. This approach could prevent many of the disputes that arise after the regulations have been formulated.

As mentioned, Atherley's concern is with the potential conflict between legislated medical tests, like audiometry, and human rights. Unfortunately, the discussion of these and related issues has the potential to disparage occupational medicine generally and the ethics of the occupational physician in particular.

However, as pointed out by Richman[34] and Gracie,[35] a number of legislative statutes, regulatory bodies and codes of ethics have evolved to influence the behaviour of occupational physicians. These, of course, are to be added to the individual physician's own ethical constructs. Hence occupational physicians usually are extremely careful not to breach confidentiality, to avoid discrimination in job placement based on inappropriate medical tests and generally to act in a manner to enhance the social validity of the various tests that they conduct.

Conclusions

1) The controversy concerning the scientific and social validity of routine audiometry in industry has been reviewed.

2) A summary of the scientific and medical literature indicates that some of the criteria needed to completely assess validity, such as sensitivity and

specificity, are not available. However, research results have indicated that the predictive value of a positive test for industrial audiometry is approximately 80 per cent. The scientific validity of audiometry in industry can be maximized by various test standardization procedures to improve audiometric reliability and by the utilization of an appropriate audiometric action level such as OSHA's STS rule.

3) Occupational physicians are guided by various legislative statutes, regulatory bodies and codes of ethics as well as by their own ethical constructs, which should ensure that in their practice of occupational medicine they will attempt to maximize the social validity of any medical screening programs, such as audiometry, with which they are involved.

   However, legislators should attempt to minimize any real or imagined potential conflicts between medical monitoring in industry and human rights by formulating clear and unambiguous legislation about the implementation and utilization of test results of medical screening procedures like audiometry.

4) Companies should have hearing conservation programs that include audiometry for those employees exposed to noise levels at or above 85 dBA.

Résumé

Ce document examine la controverse concernant la validité scientifique et sociale de l'audiométrie dans l'industrie. Il traite des composantes de la validité — théorique, pratique, intrinsèque, concourante et prévisionnelle — ainsi que de sa fiabilité dans le cas de l'audiométrie tonale. Il est possible d'améliorer la validité scientifique en faisant appel à des procédures de normalisation destinées à réduire la variabilité et en utilisant des niveaux d'intervention tels que la règle de modification du seuil type de l'OSHA. En conclusion, ce document indique que les compagnies devraient adopter des programmes de protection auditive comportant des tests audiométriques pour les employés qui se trouvent exposés à des niveaux de bruit de 85 dBA ou plus.

References

[1]Atherley GRC, Duncan JA, Williamson KS. The value of audiometry in industry. J Soc Occup Med 1973; 23: 19-21.

[2]Atherley G, Johnson M. Audiometry — the ultimate test of success? Ann Occup Hyg 1981; 27: (4):, 427-47.

[3]Last John M. A dictionary of epidemiology. Toronto: Oxford University Press 1983.

[4]Department of Clinical Epidemiology and Biostatics, McMaster University Health Sciences Centre. How to read clinical journals: II. To learn about a diagnostic test. Can Med Assoc J 1983; 124: 703-10.

[5]Mausner JS, Bahn AK. Epidemiology: an introductory text. WB Saunders, Toronto: 1974.

[6]Pelmear PL, Pike MJ. Planning a provincial hearing conservation program. In: PW Alberti, eds, Personal hearing protection in industry. New York: Raven Press, 1982. 569-76.

[7]Payton Otto D. Research: the validation of clinical practice. Second printing. Philadelphia: FA Davis Company, 1980.

[8]Noble WG. Assessment of impaired hearing. A critique and a new method. New York: Academic Press, 1978.

[9]Olishifski JR. Technical guide No. 9. Background for loss of hearing claims. 2nd ed. Chicago: Alliance of American Insurers, 1981.

[10]Alberti PW, Morgan PP, LeBlanc JR. Occupational hearing loss — an otologist's view of a long-term study. Laryngyoscope 1974; 84: 1822-34.

[11]Dobie RA, Archer RJ. Results of otologic referrals in an industrial hearing conservation program. Otolaryngol Head Neck Surg 1981; 84: 294-301.

[12]American Academy of Ophthalmology and Otolaryngology. Guide for conservation of hearing in noise. Rev ed. Rochester, MN, 1973. Custom Printing Inc.

[13]Schmidek ME, Layne MA, Lempert BL, Fleming RM. The NIOSH survey of hearing conservation programs. Sound and Vibration. 1976; Jan: 18-33.

[14]Robinson DW. Variability in the realization of the audiometric zero. Ann Occup Hyg. 1960; 2: 107-26.

[15]Atherley GRC, Dingwall-Fordyce I. The reliability of repeated auditory threshold determination. Brit J Industr Med 1963; 20: 231-35.

[16]Hetu R. Critical analysis of the effectiveness of secondary prevention of occupational hearing loss. J Occup Med 1979; 21: 251-54.

[17]High WS, Glorig A. The reliability of industrial audiometry. J Aud Res 1962; 2: 56-65.

[18]Pelmear PL, Hughes BJ. Self-recording audiometry in industry. Br J Ind Med 1974; 31: 304-9.

[19]Dobie RA. Reliability and validity of industrial audiometry. Implications for hearing conservation program design. Laryngoscope 1983; 93: 906-27.

[20]Royster JD, Royster LH. Comparing the effectiveness of significant threshold shift criteria for industrial hearing conservation programs. Occupational Safety and Health Administration, U.S. Department of Labour, 1982.

[21]Ruth RA. Audiometric evaluation of noise induced hearing loss. The otolaryngologic clinics of North America; Aug 1979; 11: (3): 639-54.

[22]Harford ER. Industrial audiology. In: Lipscomb DM, ed. Noise and audiology. Baltimore: University Park Press, 1978.

[23]Cotrell RW. Chairman, Medical Aspects of Noise Committee, American Counsel of Otolaryngology. The otologic referral criteria for occupational hearing conservation programs. Otolaryngologic Clinics of North America; 1979; 12: (3): 635-36.

[24]Occupational Health and Safety Division. Proposed Regulation under the Occupational Health and Safety Act, 1978 and Related Codes. Noise — designated substance. Jun 24, 1981. Ontario Ministry of Labour.

[25]Occupational Health and Safety Division. The report on the designation of noise in Ontario, vol. 2. Nov 1982, Ontario Ministry of Labour.

[26]Burns W, Robinson DW. Audiometry in industry. J Soc Occup Med 1973; 23: 86-91.

[27]Robinson DW. The relationship between hearing loss and noise exposure. National Physical Laboratory, Teddington, England, 1968.

[28]Robinson DW. Estimating the risk of hearing loss due to exposure to continuous noise. In: DW Robinson, ed. Occupational hearing loss. British Acoustical Society. New York: Academic Press, 1971: 43-63.

[29]Manninen O. Studies of combined effects of sinusoidal whole body vibrations and noise of varying bandwidths and intensities on TTS_2 in men. Int Arch Occup Environ Health 1983; 51: 273-88.

[30]Health and Safety Executive. Audiometry in industry. London: HMSO, 1978.

[31]Else D. A note on the protection afforded by hearing protectors. Implications of the energy principle. Ann Occup Hyg 1973; 16: 81-3.

[32]Karmy SJ, Martin AM. Employee attitudes towards hearing protection as affected by serial audiometry. In: PW Alberti, ed. Personal hearing protection. New York: Raven Press, 1982.

[33]Atherley G. Human rights versus occupational medicine. Internat J Health Services 1983; 13: (2): 265-75.

[34]Richman J. Ethics in occupational health (Letter to the Editor). Ont Med Rev 1984; Apr: 155-6.

[35]Gracie JP. Ethics in occupational health (Letter to the Editor). Ont Med Rev 1984; Apr: 156.

J.W.F. Cowell, M.D., M.Sc., C.C.B.O.M.

Organization and Management of Occupational Health and Safety Programs

Summary

This paper briefly discusses some of the key issues and problems that must be considered in the provision of occupational health and safety services to both large and small industries.

It also offers a model for the organization and management of these services.

Any discussion of the organization and management of occupational health and safety for either a large or a small industry must take into consideration a number of important facts and consider several important ethical and social attitudes.

— Ninety per cent of North American workers work in establishments of less than 250.[1]

— In Canada 97 per cent of all businesses make less than $2,000,000 in gross sales.[2]

— It is estimated that in the U.S. alone there are over 300,000 new cases of occupational diseases annually, resulting in 100,000 deaths per year.[3]

— In the U.S. it is estimated that there is a 16 billion-dollar annual cost associated with occupational accidents and illnesses.[4]

— There are over 50,000 chemicals in use.[5]

— Some reputable scientists feel that 20 per cent of future cancers may be associated with occupational exposures. Others feel this number may be far higher.[6]

— The highest accident rates occur in industries employing less than 250.[7]

— In the U.S. and Canada estimates show that health services for industry are provided by around 11,000 M.D.s, around 3,000 of whom are full-time, and that of this number, fully one quarter may never see patients. Furthermore, nearly all of these M.D.s are located in the 12,000 establishments with more than

J.W.F. Cowell, M.D., M.Sc., C.C.B.O.M.
Vice-President,
NOVA
P.O. Box 2535,
Postal Station M,
Calgary, Alberta
T2P 2N6

*Presented to the Canadian Society of Safety Engineering, 15th Annual Professional Development Conference, September 23-26, 1984, Holiday Inn, Winnipeg.

500 workers. These establishments make up less than one per cent of the worksites and employ 25 per cent of the civilian work force. The remaining workers are without any form of preventive occupational health services.[8,9]

Just relating these few random facts would indicate that 90 per cent of the working population is probably exposed to many of the 50,000 chemicals that may produce 20 per cent of future cancers and also work in physically hazardous environments that account for the highest rate of accidental injuries. And yet this group receives little, if any, occupational health and safety attention by the few available practitioners.

Furthermore, even if enough health and safety manpower existed, the 97 per cent of Canadian businesses that make gross annual sales of less than $2,000,000 probably couldn't afford occupational health and safety services unless some special financial arrangements were made.

At the present time, Canadian medical schools, nursing schools, trade schools and universities are simply not training anywhere near enough people to practise the skills needed for occupational health and safety management in the workplace. Furthermore, business people, tradespeople, employees, union leaders and ordinary people are generally unaware of, or are unconcerned about, health hazards in the workplace. Perhaps one of the basic strategies for society as a whole would be to introduce the idea of safe work practices and the importance of the working environment on health as early as elementary school.

In past decades health scientists have focused their attention on curative medicine with the develoment of antibiotics, surgical techniques and technical innovations, etc. and engineers and industrialists have focused their attention on making bigger, more powerful and more efficient machines. While medical scientists have paid attention to the prevention of epidemics of infectious diseases through improved sanitation and immunization, they have remained relatively unmindful of the powerful impact that industrialization has had on health.

The World Health Organization defines health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.' The goal is 'Health for All' by the turn of the century. If this goal is to be realized, the policy objectives of all countries for all populations must include programs to

improve workers' health. In the developed countries these initiatives will focus on preventive measures, and in the underdeveloped and third world countries the focus will be on preventive as well as curative measures. The effort will have to be multi-disciplinary, using medical, technical, legal and social skills among others. The strategies must also include worker involvement and responsibility, joint health and safety committees and improved education and knowledge of all people with regard to the relationship of health and the working environment.

In Canada the accepted ethical and social attitude is that no one should be damaged while at work. Unfortunately, we know that the translation of this fine attitude into reality doesn't routinely happen for a whole host of reasons that are primarily based on a general lack of knowledge and resources.

I doubt that anyone in Canada would seriously challenge the notion that one of the costs of doing business is the protection of workers from damage. Interestingly enough, businesses that do adopt a sound occupational health and safety policy find that their business costs actually go down because of reduced manpower turnover, absenteeism, compensation and material wastage costs. It's getting started, it's having the knowledge and finding the resources that present the problems. I believe that, slowly, but surely, Canadians will come to manage the health and safety of its work force effectively, but it will be no easy task.

Occupational Health and Safety Services

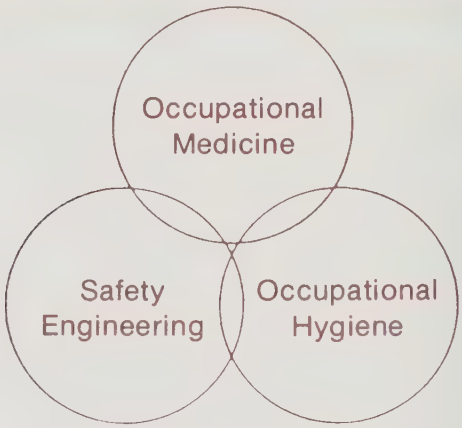
The interface between health and safety as disciplines is extremely important as we look at their management. In my view, safety engineering in its purest form deals with the prevention, investigation and management of physical hazards that cause acute or chronic physical damage to the human body. I include the field of ergonomics within that of safety engineering. Natural extensions of this discipline include loss control and risk management, which look to the protection and security of property. The science of ergonomics explores the worker/machine/working environment interface. It is concerned with the prevention of both acute and chronic injuries through the design and/or redesign of the workplace, taking into consideration human anatomy and function.

Occupational hygiene focuses its attention on the prevention, investigation and management of toxic substances and physical agents that may cause acute or chronic diseases. Natural extensions of this discipline

include environmental health and product liability where the health of the general population is a concern.

Occupational medicine, as defined by the Canadian Board of Occupational Medicine, is 'the branch of preventive medicine that deals clinically and administratively with the health needs both of individuals and groups in respect to their working environment.' Occupational medical practitioners, whether M.D.s, nurses or medics, conduct medical surveillance examinations for the early detection of occupational diseases, undertake biological monitoring to find out whether a person has been accidentally exposed to a toxic substance, provide acute health care for the sick and injured and provide health education and counselling. I see the three disciplines as distinct yet complementary (Figure 1).

Figure 1



In 1950 the Joint ILO/WHO Expert Committee on Occupational Health defined the function of occupational health services as 'the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention among workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological equipment; and to summarize: the adaption of work to man and of each man to his job.'

This 34-year-old definition holds up fairly well today, but its fulfilment remains elusive.

Organization and Management

Any organization, whether large or small, must customize its health and safety approach to suit its own needs.

Before finalizing the approach of the management of occupational health and safety services, a company must consider several key points.

Size, Type and Age of the Organization

The size, type and age of the organization as a whole must be appreciated so that the most effective use and allocation of resources can be made. For example, a very large and new manufacturing complex with state-of-the-art environmental design may not require the same resources as a smaller, older plant that needs a great deal of health monitoring and redesign.

Characteristics of the Work Force

The average age of the actual work force is also very important. For example, where employees have worked in a polluted environment for a long time, industrial hygiene and medical resources must be emphasized. Safety training may not be as critical where experienced workers have work-acquired savvy and, correspondingly, show lower accident rates. In contrast, a less experienced population will need extensive safety instruction.

Worksites and Work Practices

Once a general appreciation of the overall plant characteristics is obtained, individual worksites and work practices must be analysed, for it is here that the primary and immediate strategies of changing the work environment, protecting the worker and changing the way work is performed occurs. Particular attention must be paid to:

— work practices - How is work actually performed?
— physical hazards - Hazards that may result in personal injury.
— toxic substances/physical agents - Hazards that may result in an occupational disease.

Policy/Procedures

It is essential that a written occupational health and safety policy exist. If it does, is it relevant and is it used? What are the current programs and practices? It

may be that some are very good and should be retained; others should be reviewed; new ones may have to be introduced.

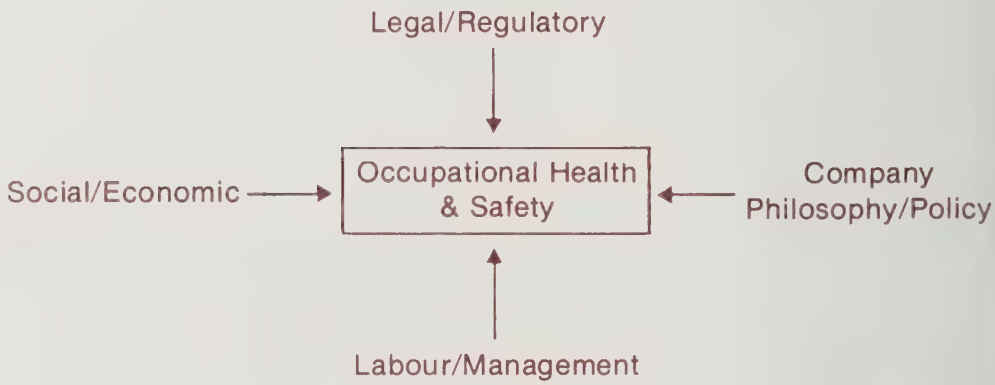
Employee Expectations and Knowledge

It is absolutely vital to determine the employees' expectations and knowledge. Many will have a very poor understanding of the relationship of the working environment to health and safety. Others may have unreasonable expectations of what can, and should, be done. Also, while line management from the president on down is legally and morally responsible for worker health and safety, employees are expected to act in a reasonable and responsible manner.

External Influences

There are four key influences that impact on effective occupational health and safety management (Figure 2).

Figure 2 **Contextual Framework — External Influences**



These are:

— legal/regulatory
— company philosophy
— labour/management relationship, and
— social/economic

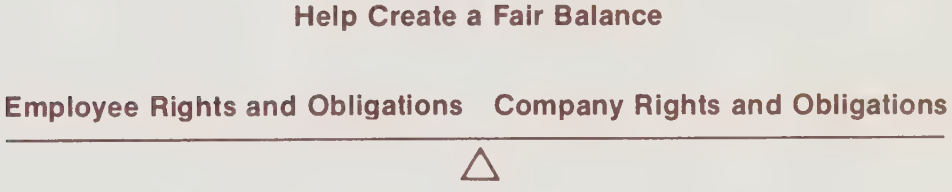
In Canada there are at least 13 sets of occupational health and safety laws — 10 provincial, two territorial and one federal. All have essentially the same

philosophy, but many differ in their approach. Company philosophy may be very people-oriented or it may not be. Labour/management relationships may be very harmonious or very hostile. The company may be located in an area of social diversity or unrest. It may be financially successful or on the verge of failure. All these influences will impact on the type, quality, quantity, pace and timing of an occupational health and safety program.

Role

Also, I think that it is very important to view the role of the occupational health and safety function in an organization from a philosophical standpoint. I see it conceptually as *helping to create a fair balance between the rights and obligations of the employee as an individual and those of the company.* This balancing act tries to ensure that employees are not harmed, but that if they are, they get just compensation, while, at the same time, the company is not held unfairly responsible for situations beyond its control. Striking the fair balance is part of the art of occupational health and safety practice (Figure 3).

Figure 3



Large industries, because of their greater financial resources, are able to provide occupational health and safety support as an in-house service, but small industries are not. However, whether the business is large or small, its management is obliged, both legally and morally, to ensure that its employees are not damaged in the course of doing their job. Furthermore, the business has a larger obligation to society as a whole, i.e. its services and/or products and byproducts must not pollute the environment or cause harm to the public.

In the long term, it is my contention that if the future proprietors of large and small businesses and the future providers of health and safety services are taught that the working environment has a very profound effect on health, the problems of managing occupational health and safety will diminish. Recently, engineering schools have begun to emphasize safety engineering as a discipline. A few business schools are now including occupational health and safety in their curricula, and medical and nursing schools are now introducing occupational medicine at both the undergraduate and post-graduate level. However, it will take time for the educational systems to catch up.

In the meantime, is it any wonder that the vast majority of Canadian workers are not adequately protected? Very few people, including the workers themselves, realize that they need protection, and if they do realize it, they don't know how to go about obtaining it.

Large Industries

Large industries must develop staff occupational health and safety departments to support their line operations in fulfilling the company's obligation to protect worker health and safety. The department's mission is to provide professional leadership, support and audit of operational practices.

There are many organizational models,[10] but the one that I think works best is the following one. Occupational health and safety is a complex socio-technical discipline quite different from other staff functions such as human resources, legal, treasury or benefits, etc., it should stand alone as a separate staff function with its own manager or vice president, who, in turn, reports to a senior vice president or the president.

The three critical components of the Occupational Health and Safety Department include Occupational Medicine, Occupational Hygiene and Safety Engineering.

The Occupational Medicine section, headed up by a medical doctor or a manager of occupational health services, may include M.D.s, nurses, medics, first aiders, health promotion specialists, fitness specialists and health care administrators. Some or all of these functions may be present at both the corporate and operating levels.

The Occupational Hygiene section, headed up by an occupational hygienist or a manager of occupational hygiene, may include physical scientists, engineers, toxicologists, biologists and epidemiologists. These functions will likely be present only at the corporate level, but may be present at the operating level if required by particularly hazardous environments.

The Safety Engineering section, headed up by a safety engineer, may include specialists in training, accident investigations, inspections and audits, loss control as well as ergonomics. Some or all of these functions may be present at both the corporate and operating levels.

Operating personnel always carry the primary responsibility for maintaining safe working conditions and for ensuring safe work practices.

Small Businesses

Small businesses usually do not have dedicated in-house occupational health and safety resources, and one of the biggest problems is to get small business management to realize that it has a responsibility in this area. Someone in each small business should be assigned the responsibility for managing occupational health and safety. While it is acknowledged that the small business owner or manager is usually swamped with multiple problems and has many functions to perform, he or she must still accept the fact that the business has to protect its workers. Society, governments and unions must be prepared to help the small business in fulfilling this responsibility. Governments must pass progressive legislation to lessen the financial burden of modifying and/or constructing workplaces to meet acceptable standards. Provincial health schemes must be changed to provide funds for preventive medical intervention, and money must be provided to help support medical clinics that have specialists in occupational health on staff. Money for medical training must be allocated to provide improved teaching in preventive/occupational medicine. Incentives must be provided to encourage business and engineering schools to include courses in occupational health and safety. Unions must show their concern and knowledge in constructive ways. Organizations such as the CSSE, AIHA, OMAC, COHA and COHNA must continue their good work and lobby for change.

In the meantime, there are a number of practical ways in which small businesses can get help right now. Information on occupational health and safety can be obtained:

1) through their associations, e.g., Small Business Association of Canada;

2) by association with a larger industry. For example, the small businesses may be a subsidiary or an affiliate of a large industry with an occupational health and safety group. Sometimes, small industry enters joint ventures or will be under contract to a larger industry where occupational health and safety resources can be obtained;

3) from governmental departments, WCBs, IAPAs, etc.

4) from universities and professional associations;

Occupational health and safety support services can be obtained relatively cheaply:

1) by small businesses banding together to support a clinic or consultant. There are a number of models here, especially those developed in Britain, where different businesses located in industrial parks have pooled their resources to support occupational health and safety services.[11] In Canada this is a common model for providing medical services to the east coast offshore oil and gas drilling rigs;

2) by utilizing the services of a single outside consultant. Many small companies individually contract, usually on a fee-for-service basis, with a private clinic to provide occupational health services;

3) by utilizing a hospital outpatient department. In the U.S. a number of hospitals have developed occupational health outpatient departments. In Quebec legislation is in place that would create community-health-centre-based occupational health services.[12] In Toronto, Ontario, such a clinic has been started at St. Michael's Hospital;

4) by calling upon governmental consultants. Most provincial governments are able to provide some expertise to small industry.

Conclusion

At the present time the health of the vast majority of Canadian workers is not adequately protected. This situation exists because of a general lack of knowledge throughout society concerning the impact of the working environment on health. In particular, workers often do not fully realize their own situation. Governments have, by and large, enacted adequate legislation, but need to provide more support. Medical, engineering, trade and business schools do not provide adequate training, either for future business and union leaders or for the professional health and safety specialist.

The long-term solution must include a realization by society as a whole that the working environment has a profound effect on health, and that this is the major health challenge facing the industrialized world today.

The short-term solution for large industry is to have senior management commitment along with a highly skilled in-house occupational health and safety group functioning as an independent self-standing staff department. The short-term solution for small industry is to have senior management commitment, and to seek help from a variety of outside resources.

Résumé

Ce document traite brièvement des questions et problèmes clés qui doivent être pris en considération dans la création de services de santé et de sécurité destinés aux petites comme aux grandes industries.

Il propose également un système pour l'organisation et la gestion de ces services.

References

[1]Finch A. Small business's need for occupational safety and health services. Proceedings of Clinic-Based Safety and Health Programs for Small Businesses. NIOSH publication no. 77-172: 23-33. Washington, D.C.

[2]Small business in Canada — a statistical profile 1981. Minister of State for Small Business and Tourism.

[3]Ashford NA. The magnitude of the occupational health problem and implications for public health. Proceedings of the 25th Annual Group Health Institute, Chicago, Illinois, June 23-25 1975. Washington D.C.: Group Health Association of America, Inc. 1975, 50-58.

[4]Finch, A. NIOSH Publication No. 77-172: 23-33. Washington, D.C.

[5]ILO Encyclopedia of Occupational Health and Safety; 3rd ed. 1: A-K: 450.

[6]Fischer E *et al.* An experiment to test the feasibility of integrating occupational health services into an HMO.

[7]Finch A. NIOSH publication no. 77-172: 23-33. Washington, D.C.

[8]Kerr L. NIOSH publication no. 77-172: 5-13. Washington, D.C.

[9]Canadian Board of Occupational Medicine.

[10]Walsh D. Is there a doctor in-house? Harvard Business Review Jul-Aug 1984.

[11]Gibson W, Wigget I. Organizing a group occupational health service in County Durham. J Soc Occup Med 1983; 33: 88-92.

[12]Planet J. Small firms look to hospitals for occupational health services. Hospitals, 1978; March.

Bryan J. Walker

Occupational Health and Safety Legislation: Highlights and Trends

Summary

This paper reviews the legislative and administrative framework of health and safety legislation in Canada. The trend for omnibus legislation, initiated by Saskatchewan in 1972, has now been adopted by seven of the 10 Provinces and the federal legislature, but the administrative models differ. Access to information has been clearly established, together with worker rights to participate and refuse. The enforcement powers and rights of appeal have become more comprehensive.

Reflecting the structure of government and the assignment of powers in the *British North America Act* and the territorial Acts, two distinct sets of occupational health and safety legislation are in force in each province and territory in Canada. The provincial or territorial legislation applies to the majority of the labour force in each jurisdiction. The federal legislation, the 1970 *Canada Labour Code* with its 1978 amendments, applies only to those in a limited number of industries. In total, 13 jurisdictions legislate in the area of occupational health and safety.

While this fragmented structure has the potential for wide differences to have developed, the legislation in most jurisdictions is similar while differing in aspects that reflect each jurisdiction's individual industrial, social and political settings and how recently they have taken legislative initiatives in the health and safety field. The similarities can be attributed to two main factors: legislators in each jurisdiction have tended to adopt legislative provisions from other jurisdictions as opposed to embarking in new directions; and the impetus for legislative change from the labour movement has been national in scope with provincial labour organizations following the lead of the national and other provincial labour organizations.

The Legislative Framework

Prior to 1972 all occupational health and safety legislation was fragmented into distinct parts that dealt with specific industrial sectors. However, beginning with Saskatchewan (1972), eight jurisdictions have enacted omnibus statutes that group all or nearly all industries under one general act and deal with industrial sector differences in regulations. Saskatchewan's lead in enacting omnibus legislation was followed by Alberta, Manitoba, New Brunswick and Ontario (1976); the federal government and Newfoundland (1978); and Quebec (1979). Although British Columbia has not enacted a specific omnibus statute, the changes in its occupational health and safety regulations, under the Workers' Compensation Act, reflect the substantive reforms of the other eight jurisdictions.

Bryan J. Walker,
Occupational Health and Safety Commission,
P.O. Box 6000,
Fredericton,
New Brunswick
E3B 5H1

Prince Edward Island, the Yukon and the Northwest Territories either do not have omnibus legislation or they have not adopted the substantive reforms of the other jurisdictions. Nova Scotia is the only jurisdiction that still retains a solely sectoral approach. However, a tripartite committee is now reviewing this.

Although the trend is to enact omnibus statutes, at this stage in their evolution, the changes should more properly be characterized as quasi-omnibus since all of these jurisdictions either provide exemptions or deal with specific industrial sectors and/or occupations through specialized statutes or regulations or administrative structures. In particular, mining, highway transportation, firefighting, pipelines, policing, hospitals and petroleum exploration, drilling and production are dealt with, in no consistent manner across jurisdictions, by specialized legislation and/or by exemption from the omnibus legislation.

Nonetheless, the trend to omnibus legislation continues, and a second generation of statutes affirming this trend was enacted in Saskatchewan (1978), Alberta and Ontario (1980), New Brunswick (1983) and by the federal government (1984).

The Administrative Framework

Under the sectoral approach to occupational health and safety legislation, there was a fragmented approach to the administration of the legislation. However, as statutes have become more comprehensive, there has been an accompanying consolidation of the administrative responsibility for occupational health and safety legislation under one government department or agency. With this administrative change, there has been a diminution in the lead role played by Departments of Labour, which, in some jurisdictions, represents a conscious effort to remove occupational health and safety from traditional departments whose role it is to arbitrate labour-management disputes and place it with new agencies whose role it is to forge consensus decision-making.

While the differences are ones of degree, and subject to some subjective interpretation, Alberta, New Brunswick, Newfoundland, Quebec and Saskatchewan have gone the farthest in consolidating administrative responsibility in conjunction with omnibus legislation, although British Columbia, Manitoba, Ontario, Prince Edward Island and the Yukon have taken steps in this direction. However, despite these efforts, the multiplicity of secondary agency involvement in occupational health and safety still remains in all

jurisdictions and, to some extent, will probably remain for some time as there is a diminishing benefit to be gained from consolidating agencies and functions whose impact on accident prevention is marginal or serendipitous.

As mentioned earlier, new administrative structures to deal with the occupational health and safety policy field have been established in a number of jurisdictions. It is worth noting that three of the five jurisdictions that have gone the farthest in consolidating administrative responsibility — Alberta, New Brunswick and Quebec — have done so through new administrative structures.

The Alberta model of consolidated administration is more in the traditional mode in that it has established a minister responsible for workers' health, safety and compensation, who oversees both the compensation system and the accident prevention and enforcement functions, although the two divisions are distinct. While some jurisdictions have accident prevention and enforcement functions under their compensation boards, the Alberta model is a clear break from that pattern in that accident prevention and enforcement functions are not subservient to the compensation functions.

In Quebec the Commission de la santé et de la securité du travail has been established, which is responsible for occupational health and safety and workers' compensation. Unlike the Alberta model, the Quebec commission is an autonomous corporation with a tripartite board of directors comprising a chairman representing government and seven members each representing employers and workers' organizations.

In New Brunswick a Crown corporation reporting through a minister has been established to administer occupational health and safety. Like the Quebec model, this agency has a tripartite board of directors, and all responsibility for the administration of the legislation has devolved on the corporation.

The tripartite model for dealing with occupational health and safety is common in western Europe, and is the basis of some legislative proposals for occupational health and safety in Australia. While tripartite structures have not been widely used in Canada, their use is increasing. In addition to the Quebec and New Brunswick models, the legislation establishing the Canadian Centre for Occupational Health and Safety sets up a tripartite governing structure. Other intitiatives in economic areas are also adopting tripartite models.

Although this may not represent a trend in the administrative framework for occupational health and safety legislation, these developments and the increasing use of statutory advisory bodies clearly indicates that there is, at the minimum, a trend toward increased consultation and consensual decision making.

Access to Information

Employer and, especially, worker access to information is now clearly established, both in legislation and in administrative practice.

Workers' representatives in eight jurisdictions have the right to accompany occupational health and safety inspectors in the conduct of their inspections. Federally, and in Nova Scotia, the Northwest Territories, Prince Edward Island and the Yukon no explicit provision is made for workers to accompany inspectors, but none of the legislation prohibits it. As a result, the practice varies from workplace to workplace.

Also, workers have some form of access to inspectors' reports, although this access varies considerably among jurisdictions. Only Nova Scotia and Prince Edward Island have no posting requirements in regard to inspection reports. However, the posting requirements vary substantially in the other 11 jurisdictions. Despite these variations, there is evolving a more open access to inspection reports.

There is an increasing trend to 'right to know' legislative provisions in respect to proper training of workers and to informing them of the risks involved in their jobs.

All jurisdictions impose a duty on employers to train workers adequately, but the generality of the provisions in some cases may mean that, practically, they are not legally enforceable.

In six jurisdictions, Manitoba, Newfoundland, New Brunswick, Ontario, Quebec and Saskatchewan, the duty to train workers is combined with the duty to inform them of the risks involved in their jobs. In addition, Ontario and, to some extent, New Brunswick have explicitly imposed a duty to inform workers of potential hazards.

In the area of toxic substances, Saskatchewan, Quebec, New Brunswick and Newfoundland require written records to be maintained and made available to inspectors and joint health and safety committees. Other jurisdictions require training or warnings in special situations, but there is no uniformity. However, the right to know, to have access to information and to be informed about risks and hazards is a legislative

trend that is definitely well-established. The tripartite, inter-jurisdictional Workplace Hazardous Materials Information Systems project, which is now in progress, affirms this right of access to information.

The Right to Participate

The right to participate and be consulted in the decision-making process on occupational health and safety issues is becoming well-established in most jurisdictions. With the exception of Nova Scotia and Prince Edward Island, all jurisdictions make provisions for this participation through joint health and safety committees and/or representatives. In some jurisdictions their establishment is mandatory, while in others their establishment is on a directed basis. The differences tend to be of degree. The general principles that guide the functioning of committees and their roles in the 11 jurisdictions that have them are broadly the same.

Developments in this area of legislation are towards making the establishment of committees mandatory at workplaces with a designated number of employees.

Enforcement Powers and Rights of Appeal

In nearly all jurisdictions the powers of inspectors have gradually become more comprehensive. In addition to this expanded authority, their enforcement powers have been more sharply defined in order to clarify that authority. The powers of inspectors are generally consistent among the various jurisdictions.

Along with this expansion and clarification of authority, most jurisdictions now make statutory provisions for either an administration review or appeal from decisions of their inspectors. While a judicial review has always been available, the trend is toward broadening the appeal process by providing for such a review in the occupational health and safety statutes.

The Right to Refuse

The statutory right to refuse unsafe work is now incorporated into the legislation of 10 jurisdictions, with the exception of Nova Scotia, Prince Edward Island and the Yukon. However, Ontario exempts workers in specific occupations and limits it in other situations and Quebec provides for exemptions in specific situations or where ordered. Other jurisdictions have modified the 'right to refuse' protection by specifying its use only where there is an unusual danger, an imminent danger or an undue hazard.

Notwithstanding these limitations on the right to refuse, where it is applicable, the gist of most statutes is similar. However, of the eleven jurisdictions, only Canada, Alberta, Manitoba, New Brunswick, Newfoundland, Ontario, Quebec and Saskatchewan have provisions in their legislation to remedy disciplinary action taken against a worker who exercises the right to refuse. Without this remedy, the statutory right to refuse offers no more protection to a worker than is available to that worker under common law. However, with eight jurisdictions having effective statutory right to refuse provisions, the evolution is toward including remedy as part of the statutory right.

Conclusion

While this paper has selectively focused on the major areas covered by occupational health and safety legislation, there are numerous other similar provisions. The provisions dealing with application of the statute, the duties imposed on various persons or groups, confidentiality, notices in case of accidents, liability and penalties are generally consistent from jurisdiction to jurisdiction.

Although differences exist, an overview of the legislation reveals distinct nationwide trends. In most jurisdictions, occupational health and safety law has been consolidated into a quasi-omnibus statute with a corresponding consolidation of administrative responsibilities. The statutes are generally being liberalized to permit greater worker access to information affecting them, and workers are being given a greater say and responsibility for workplace health and safety through joint health and safety committees and other such mechanisms that ensure their participation in the decision-making process. Appeal procedures and enforcement measures have been expanded and clarified, and the scope of occupational health and safety law is being broadened to include workers previously excluded. That these changes have taken place is not surprising given the impact of such factors as an increasingly sophisticated work force and changing technology in the workplace. The challence that we face, however, is keeping our legislation current with further changes in attitudes towards work and ever increasing changes in the way that work is carried out.

Résumé

Ce document passe en revue la structure législative et administrative des lois concernant la santé et la sécurité au Canada. La tendance vers une législation d'ensemble, lancée par la Saskatchewan en 1972, vient d'être adoptée par sept provinces ainsi que par le parlement fédéral, mais les modèles administratifs diffèrent. L'accès à l'information ainsi que les droits de participation et de refus dont jouissent les travailleurs ont été clairement définis. Les pouvoirs d'exécution et les droits d'appel ont été étendus.

Designated Substances Regs: Examining Physicians' Guidelines*

The *Occupational Health and Safety Act* (the Act), section 41(2)14, permits prescription by regulation of any biological, chemical, or physical agent as a designated substance. Designated substance regulations can prohibit, regulate, restrict, limit or control the handling of, or exposure to, or the use and disposal of any such substance. As of the date of publication of these guidelines, nine substances have been designated under the Act, namely: lead, mercury, vinyl chloride, coke oven emissions, asbestos, isocyanates, silica, benzene and acrylonitrile. A number of other designated substance regulations are in various stages of development. These regulations incorporate a number of concepts and approaches to occupational health that are new to Ontario. Among the most important of these are requirements for an assessment of the workplace and, where called for, a control program that must include provisions for engineering controls (for example, ventilation), work practices, hygiene practices and facilities, respirators, air monitoring, record keeping and medical surveillance.

An Overview of the Regulations

In most cases, designated substance regulations apply to employers and workers at workplaces where two conditions are met:

- the substance is present in the workplace, and
- a worker is likely to absorb some of the substance that is present by inhalation, ingestion or skin contact.

The regulations require that:

- the exposure of workers to the substance in the workplace be controlled,

*Reprinted from *Ontario Medical Review*, January 1985, Volume 52, Number 1.

- an assessment be conducted to determine whether inhalation, absorption or ingestion is likely and whether the health of a worker may be affected by exposure to the substance; and
- a control program be established when the assessment reveals that the health of a worker may be affected by the substance.

Certain regulations require that employers take all necessary measures and procedures to ensure that exposure of a worker to a particular hazardous agent is reduced to the lowest practical level and, in any case, not to exceed the standard set for that hazardous agent.

The regulation must be implemented by the employer in consultation with the joint health and safety committee (the committee), which must be established under section 8 of the Act.

The Role of the Joint Health and Safety Committee

A committee is required at workplaces where a designated substance regulation applies. The employer must consult with the committee and the members can make recommendations regarding the development of the assessment and the control program.

The committee must also receive, on a confidential basis, the opinion of the examining physician that a worker is fit with limitations or unfit for continued exposure to the designated substance. Under some designated substance regulations, the committee must also receive the results of clinical exposure tests, e.g. lead in urine and blood, mercury in urine.

The Purpose of Assessments

An assessment is essentially a detailed and methodical examination of the working environment in which exposure to the designated substance may be occurring. It is performed to determine:

- the existing exposure of workers to the substance;
- whether workers are inhaling, ingesting or absorbing the substance or are likely to do so in the future;
- whether or not the health of a worker may be affected by exposure to the substance.

The conclusions of the assessment will determine whether a control program is required, and

- the employer shall give a copy of the assessment to the joint health and safety committee.

Control Program Requirements

A control program must spell out in detail the necessary measures that must be taken to protect workers from excessive exposure to the designated substance.

This program must be developed when the assessment has revealed that a worker is *likely to absorb* the substance by inhalation, ingestion or skin contact, *and* that his or her *health may be affected* by such exposure.

The regulations require that every control program must include provisions for:

1. Engineering controls, work practices and hygiene practices.

2. Methods and procedures to monitor by air sampling the concentration of the substance in workplace air and the levels of exposure of workers to the substance.

3. Personal records of the levels of exposure of workers to the substance.

4. The medical examinations and clinical tests required by the control program are to be performed at the expense of the employer and must meet the requirements set out in the regulation and the Code for Medical Surveillance referenced by the regulation. The records of medical examinations and clinical tests of workers are to be kept by the examining physician.

The employer is responsible for developing and implementing the control program in consultation with the committee. The details will naturally vary with the work situation, but all components have to be included.

The control program should identify which groups of workers will be required to undergo medical examinations, and specify the frequency of such examinations. (It may be desirable to set different examination schedules for different groups of workers, according to the extent of exposure). The control program should also identify the examining or supervising physician for the medical surveillance program.

The Examining Physician

The regulations do not stipulate who shall be the examining physician, thus allowing the worker to select the doctor of his choice. As a result, the examining

physician may be the company doctor, a private consultant with whom the employer contracts services, a physician on the staff of a clinic whose services are used by the employer, or the personal physician of the worker. Where more than one examining physician is required, one should be appointed as the supervisor or co-ordinator, but every examining physician must know the content of the appropriate Code for Medical Surveillance and his responsibilities.

The Medical Surveillance Program

The designated substance regulations require that the control program provide for a medical surveillance program that must include:

- pre-placement and periodic medical examinations;
- clinical tests;
- health education;
- record keeping.

The objectives of the medical surveillance program are both preventive and remedial. Medical conditions that may be aggravated by exposure to the substance or physical agent should be detected at the pre-placement and periodic examinations. By providing a regular check on workers exposed to the substance, to detect subsequent adverse effects, the examining physician can alert the employer and the committee to exposure problems in the workplace that might otherwise go unrecognized. This should ensure that remedial steps will be taken. Health education for workers on the health effects of the substance and the manner in which exposure can be limited are also preventive functions of the program.

Responsibility for Medical Surveillance

The regulations and the Codes for Medical Surveillance place a number of responsibilities on different parties in the workplace with respect to health. The employer is responsible for seeing that the medical surveillance programs are carried out in accordance with the regulations and the codes. He must bear the cost of any required medical examinations and clinical tests, and ensure that analyses of clinical tests conform to the requirements of the appropriate code. He shall also provide the physician with a copy of the exposure records of workers.

The regulations and the codes also place specific obligations on the examining physician. The joint committee must receive advice and information from

the physician on a confidential basis, and use this information in evaluating and improving occupational health controls.

Workers are required to undergo medical examinations and clinical tests as specified in the codes and the control programs.

The Clinical Tests

Some of the required clinical tests measure directly the concentration of the substance in the blood or urine of the worker and provide an indication of the amount that has been recently absorbed. Others measure a specific function of the body that may be affected by exposure.

Some of the Codes for Medical Surveillance reference one or more 'action levels'. If two separate action levels are specified, the physician is required to review work practices, health status and personal hygiene when the lower level is reached. When the higher level is reached, and this result is confirmed by a second test, the worker must be removed from his usual exposure at the workplace.

The use of action levels does not mean that clinical tests are the only trigger for action. The examinating physician must use professional judgement to identify other signs of possible overexposure to the substance and advise appropriately. The tests, however, will help to provide safeguards in the event such signs are not detected.

Physician's Reporting Protocol

The regulations require the physician to advise *the employer* whether the worker is fit, fit with limitations or unfit for exposure to the designated substance. This determination is a professional judgement based on the results of medical examinations and clinical tests. The physician must give this opinion without disclosing to the employer the results of the examinations or tests.

Some of the designated substance regulations require the physician to advise *the committee* in writing of the results of clinical tests, along with an opinion as to how these tests should be interpreted. Other regulations require the physician to just give to the committee an opinion as to the fitness of the worker for exposure. In all such cases, the committee must receive this information on a confidential basis. If the physican has advised the employer that a worker is fit with limitations or unfit, he or she must also report this information to the *Chief Physician of the Occupational Health Medical Service of the Ministry of Labour.* These requirements are specified in sections 16(1), 16(2)

and 16(5) of the designated substance regulations.

It should be noted that by section 3(3) these regulations do not apply to a constructor or to an employer on a construction project in respect of those workers who work at, or on, the project. Thus there is currently no requirement for a medical surveillance program for construction workers under the designated substance regulations. However, employers under section 26(2) of the Act and section 10(2) of the Regulations for Construction Projects must give notice of an occupational illness to a director of the Ministry of Labour and must notify the Workers' Compensation Board under section 121 of their Act. The WCB Form 7 is sufficient to comply with the requirements of both statutes.

Physicians who are not examining physicians appointed under the control programs for designated substances do not have a statutory duty to report cases of occupational disease to the Ministry of Labour, but they must do so immediately if requested by the Workers' Compensation Board under section 53 of the *Workers' Compensation Act*, using Form 8. However, in order to protect the health of the worker and others at the worksite, physicians should alert the employer and the local occupational medical consultant of the Ministry of Labour of a suspected problem so that proper notification and early investigation of the circumstances may take place with implementation of any necessary controls.

The Manner in Which Employers and Committees Must Act on Medical Information

If the physician advises that a worker is 'fit with limitations or unfit', the employer is required to act on this information. The precise action taken will depend on the professional advice of the physician and the requirements of the regulation and the code. In many cases, there may be some choice as to the course of action taken, which can be worked out between the physician, the employer and the worker.

If the results of clinical tests reach the action level for removal of the worker from exposure, he must be declared unfit for work or fit with limitations to work in a low risk area in the workplace until test results drop to the levels at which the code permits return to the usual conditions of work. Where there is no mandatory removal level or where the results of clinical tests have not reached that level, the physician may still advise that a worker is fit with limitations or unfit on the basis of other indications of adverse health effects resulting from medical examination. In such cases,

removal from exposure and return to the usual conditions of work are based on the judgement of the physician.

The means by which the worker is protected against exposure may vary. It may be possible to use administrative controls, e.g. isolation of the worker from the process, job re-assignment or protective equipment to reduce or eliminate exposure of the worker. However, temporary removal from the workplace may be necessary. A worker who suffers loss of earnings due to removal from exposure is entitled to compensation in the manner and to the extent provided by the *Workers' Compensation Act.*

The employer and the committee are expected to use the advice and information received from the physician to help evaluate the need for improved workplace controls. The information that the health of a worker has been affected by exposure to a substance or that the absorption of the substance has reached an 'action level' should always be taken as an indication that workplace controls are not operating effectively.

Medical Records

The physician must keep records of medical examinations and clinical tests of workers, along with the personal exposure records of the workers, which have been provided by the employer. These are to be kept for 40 years from the earliest date of the records or for 20 years from the latest date, whichever is longer. If the physician ceases to be able or willing to keep these records, they are to be forwarded to the Chief Physician of the Occupational Health Medical Service of the Ministry of Labour, 400 University Avenue, 7th Floor, Toronto, Ontario M7A 1T7.

Copies of a worker's exposure records and the results of medical examinations and clinical tests may be given by the physician to the worker or the personal physician of the worker on the written request of the worker. If the worker has died, the records may be released to the next of kin or the worker's personal representative, upon written request.

Publications Available From the Government Book Store

Publications under the Regulation Act
vol. 112-39

Revised Regulations of Ontario, 1980 Regulation 692/80 Industrial Establishments	$2.00
Revised Regulations of Ontario, 1980 Regulation 691/80 Construction Projects	$2.00
Revised Regulations of Ontario, 1980 Regulation 694/80 Mines and Mining Plants	$2.00
Regulation respecting Lead - made under the Occupational Health and Safety Act Ontario Regulation 536/81	$1.00
Regulation respecting Mercury - made under the Occupational Health and Safety Act Ontario Regulation 141/82	$1.00
Regulation Respecting Vinyl Chloride - made under the Occupational Health and Safety Act Ontario Regulation 516/82	$1.00
Regulation respecting Coke Oven Emissions - made under the Occupational Health and Safety Act Ontario Regulation 517/82	$1.00
Regulation respecting Asbestos - made under the Occupational Health and Safety Act Ontario Regulation 570/82	$1.00
Regulation respecting Isocyanates - made under the Occupational Health and Safety Act Ontario Regulation 455/83	$1.00

Regulation respecting Benzene - made under the Occupational Health and Safety Act Ontario Regulation 732/84	$1.00
Regulation respecting Acrylonitrile - made under the Occupational Health and Safety Act Ontario Regulation 733/84	$1.00
An Occupational Health Nurse's Guide to the Preparation of a Policy and Procedure Manual	$2.00
A Guide to the Occupational Health and Safety Act	$1.00
Regulation for X-ray Safety, Registration and Plan Review made under the Occupational Health and Safety Act Ontario Regulation 263/84	.60
X-ray Safety Code, Ontario Regulation 45/84	.20

News and Notes

The Queen's University Occupational Health Centre is offering a training course in Industrial Audiometry and Hearing Conservation. This course has been designed to meet the Ministry of Labour's recommendations for appropriate training of audiometric technicians in industry. Students are recruited from among occupational health nurses and safety technicians, but those who supervise occupational health and safety programs would also benefit from the course. On successful completion of the course, students should have a knowledge of the concepts of hearing conservation, an understanding of the physical measurement of sound and the practical ability to undertake competent audiometry. They will also be aware of the ethical and legal considerations surrounding audiometry and be familiar with record keeping techniques. For further information, contact the Occupational Health Centre, Queen's University, 25 Union Street, Kingston, Ontario. (613) 547-5930.

May 6-8, 1985	Industrial Audiometry and Hearing Conservation. Details from Mrs. G. Hetherington, Occupational Health Centre, 25 Union Street, Kingston, Ontario K7L 2N6. (613) 547-5930.
May 9, 1985	Measurement and Control of Noise. Details from Mrs. G. Hetherington, Occupational Health Centre, 25 Union Street, Kingston, Ontario K7L 2N6. (613) 547-5930.

Ventilation '85

The 1st International Symposium on Ventilation for Contaminant Control will take place in Toronto in October 1985.

The program is being sponsored by Industrial Hygiene and Hazard Control Engineering of the University of Toronto and the Ontario Section of the Air Pollution Control Association.

Purpose

There is an increased concern for improving the environment in the workplace through the application

of advanced design ventilation systems for contaminant control. This conference represents the first international meeting for the exchange of scientific information among workers in the field. The conference is intended for scientists, engineers, researchers, loss control engineers and industrial hygienists from industries, research laboratories, government agencies and other organizations who are interested in worldwide state-of-technology and new technological developments in the contaminant control field. The focus of the conference will be new developments and recent significant technological advancements in the ventilation field.

Languages

The language of the symposium presentations and the proceedings will be English. Simultaneous translations will be provided in French.

Obituary

Margaret Inez Hardy

Ms. Margaret Inez Hardy, who died on January 6, 1985, was the editor of Occupational Health in Ontario from 1952 until her retirement in 1978.

Margaret was a member of the first graduating class from the Toronto East General Hospital School of Nursing, and subsequently earned a public health certificate from the University of Toronto and a baccalaureate in science (nursing) from the University of Western Ontario.

She enjoyed a variety of occupational health nursing positions that spanned such diverse industries as shipbuilding to paper making before joining the Ministry of Health, Industrial Hygiene Division as a nursing consultant in 1952. She contributed to occupational health organizations provincially and internationally, and was the first nurse appointed to the Board of Directors of the Permanent Commission and International Association on Occupational Health.

Failing health during the past few years had kept Margaret from pursuing her many occupational health interests. She will be sadly missed.

Coming Events

April 15-17, 1985	68th IAPA (Industrial Accident Prevention Association) Annual Conference, 'Join the Drive in '85'. Royal York Hotel and Metro Toronto Convention Centre. Mr. M.H. Norris, Conference Co-ordinator, IAPA, 2 Bloor West, 31st Floor, TORONTO, ONTARIO, CANADA, M4W 3N8. Tel.: (416) 965-8888.
April 29-May 2, 1985	International Symposium on Biological Monitoring of Exposure to Metals and Inorganic Compounds in Conjunction with the 189th ACS National Meeting. Call for papers: contact Dr. H.K. Dillon, Southern Research Institute, 2000 Ninth Avenue, South, P.O. Box 55305, Birmingham, AL 35255-5305. MIAMI BEACH, FLORIDA.
May 6-8, 1985	Fourth International Symposium on Hand-Arm Vibration under the auspices of the Scientific Committee on Health Effects of Physical Environmental Factors of the Permanent Commission and International Association on Occupational Health, Hanassaari Cultural Centre, HELSINKI, FINLAND.
May 7-9, 1985	Hazards in the Workplace, co-sponsored by Stanford University Department of Dermatology and the Western Occupational Medical Association, Hyatt Rickeys, PALO ALTO, CALIFORNIA. Information: Paul H. Jacobs, M.D., Dept. of Dermatology, Stanford University Medical Center, Stanford, CA. 94305.
May 8-10, 1985	International Colloquium on Safety at Work with Automation and New Technologies. BONN AND HENNEF/SIEG, WEST GERMANY.
May 14-16, 1985	5th Annual Symposium on Recent Advances in the Measurement of Air Pollutants. Call for papers. One-page abstracts to Seymour Hochheiser, MD 75, EPA Environmental Monitoring Systems Laboratory, Research Triangle Park, NC 27711. RALEIGH, NORTH CAROLINA
May 19-24, 1985	American Industrial Hygiene Conference. LAS VEGAS, NEVADA.

May 21-24, 1985	EMERGENCY '85. Mack-Brooks Exhibitions Limited, Suite 8A, Carleton Regency, 137 East 36th Street, New York, NY 10016.
June 2-7, 1985	Third Theodore F. Hatch Symposium: International Conference on the Health of Miners — Ms. Joan Houston, Executive Secretary, International Conference on the Health of Miners, University of Pittsburgh, Graduate School of Public Health, 130 Desoto Street, Pittsburgh, PA 45261, U.S.A.
June 3-5, 1985	National Noise Control Conference 'Computer and Predictive Methods for Noise Control' — Noise-Con 85, Department of Mechanical Engineering, Ohio State University, 206 West 18th Avenue, COLUMBUS, OHIO 43210, U.S.A. Tel.: (614) 422-1910.
June 11—13, 1985	Sixth Annual Meeting of the Canadian Radiation Protection Association — John J. Paciga, New Brunswick Electric Power Commission, Health Physics Department, Point Lepreau Generating Station, P.O. Box 10, Lepreau New Brunswick, E0G 2H0, Canada. Tel.: (506) 659-2102 ext. 324. SAINT JOHN, NEW BRUNSWICK, CANADA.
August 18-24, 1985	Health Care Expo '85. WASHINGTON, D.C.
September 1-5, 1985	2nd International Conference of the International Society for Respiratory Protection. University of York, YORK, ENGLAND.
September 2-6, 1985	Ninth Congress of the International Ergonomics Association, — c/o Congress Secretariat, Meon House, Petersfield, Hampshire GU32 3JN, U.K. Tel.: 0730 66561 Telex: 86181 Meon G. BOURNEMOUTH, U.K.
September 2-6, 1985	Sixth International Symposium on Inhaled Particles 1985 — Dr. N.P. Crawford, Institute of Occupational Medicine, 8 Roxburgh Place, Edinburgh EH8 9SU, Scotland, U.K. Tel.: 031-667 5131. CAMBRIDGE, U.K.
September 10-12, 1985	Fourth International Symposium 'Epidemiology in Occupational Health' — Dr. P.A. Bertazzi, Secretary, IV International Symposium, Epidemiology in Occupational Health, 8 Via S. Barnaba, 1-20122 Milano, Italy. Tel.: (02) 581610. COMO, ITALY.

September 10-13, 1985	Second National Conference on Occupational Medicine and Annual Meeting of OMAC and the Canadian Board of Occupational Medicine. Contact: Dr. J.W. Cowell, President, OMAC, c/o NOVA, P.O. Box 2535, Postal Station M, Calgary, Alberta, T2P 2N6. CALGARY, ALBERTA, CANADA.
September 16-20, 1985	Golden Jubilee of the Society of Occupational Medicine. BIRMINGHAM, ENGLAND.
September 16-20, 1985	12th International Colloquium on the Prevention of Occupational Risks in the Construction Industry. Contact Secretariat of the Colloquium. Bau-Berufsgenossenschaft Hamburg. Holstenwall 8-9, D-2000 Hamburg 36 (Federal Republic of Germany). HAMBURG, GERMANY.
September 19-21, 1985	The Challenge of the Lumbar Spine — 7th Annual Meeting. Contact: Devi Segal, Program Co-ordinator, The Institute for Low Back Care, 2737 Chicago Ave., Minneapolis, MN 55407, Tel.: (612) 874-6666. Amfac Hotel, MINNEAPOLIS, MINNESOTA.
September 23-25, 1985	Radioactive Waste Management, WINNIPEG, MANITOBA, CANADA.
September 26-27, 1985	Information Meeting, Canadian Nuclear Fuel Waste Management Research Program, WINNIPEG, MANITOBA, CANADA.
October 1-3, 1985	Ventilation '85, 1st International Symposium on Ventilation for Contaminant Control, Royal York Hotel, TORONTO, CANADA. For details contact Dr. H.D. Goodfellow, Hatch Associates Ltd., 21 St. Clair Avenue East, Toronto, Ontario, Canada M4T 1L9.

Ontario Ministry of Labour

Occupational Health and Safety Division

Occupational Health Branch

400 University Ave.
Toronto, Ontario
M7A 1T7

Telephone:
(416) 965-3610

ISSN 0705-9388